

A Tale of Three Carrots

By Ran Goel



**METCALF
FOUNDATION**

Illustrations by
Kim Keitner

A Tale of Three Carrots

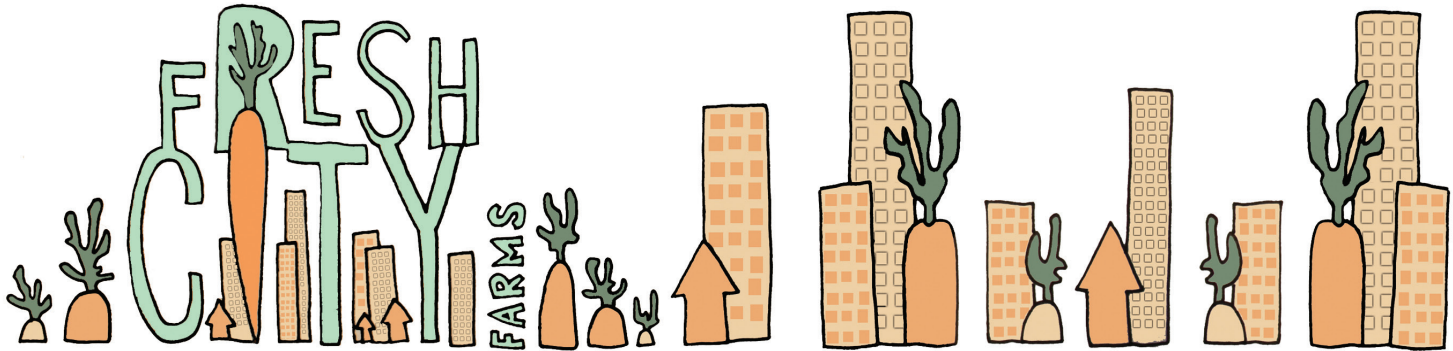
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INTRODUCTION

Farmers produce more than twice the food that all seven billion of us need. Our grocery stores are overflowing with thousands of products from around the world, and yet our food system is broken.

We have created a system that undermines our health, our environment, our economy, and our ability to feed society's most vulnerable.

Some people are not getting enough food. In fact, almost a billion souls suffer the indignity of hunger in an era of plenty. Some are not getting the right kind of food. And all of us feel the impact of the billions of kilograms of chemicals used to grow our food. Health effects ranging from spikes in certain cancers, hormone levels, sperm counts, and allergies have been associated with such chemicals.

Rates of diabetes, heart disease, and obesity have doubled and tripled in the last generation. Future generations will suffer from the often irreversible impact our food system is having on the natural environment, including hastening climate change, losing our best farmland, and reducing biodiversity.

This booklet tells the story of how our food is grown and sold. But it also tells an alternative story of how farming and food buying can be different. The decision to safeguard our health, our land, and our future is ultimately in our hands. By following the tale of three carrots from three different farms, we can compare and contrast the options that are available to us when growing, selling, and purchasing food.

The aim is not to supply answers or a blueprint for how to reform our food system or what we should each eat. Rather, it is meant to provoke us into understanding that there is a problem and imagining alternatives to the status quo.



CARROTS 101

Carrots are in vogue these days. Thanks largely to the popularization of the baby carrot, or rather the baby-cut carrot, we munch on twice as many carrots today as we did just two decades ago. Most of us will eat well over ten thousand carrots in our lifetime.

This renaissance includes a reach back to this friendly vegetable's roots (pardon the pun) with the triumphant return of multi-coloured, flay-legged heirloom varieties at farmer's markets. Believe it or not, the orange colour of today's carrot is a pretty recent development in its five thousand year history. Originating in present-day Afghanistan and Iran, carrots were historically white, purple, or yellow. It was not until the seventeenth century that Dutch growers popularized an orange variety

in tribute to William of Orange, a wealthy nobleman who led the struggle for Dutch independence in the 1500s. Carrots were not grown in North America until they were brought over by Virginia colonists in the sixteenth century.



The carrot's popularity is well earned. They are fun. They store well, which might be why they were the first vegetable to be preserved. They also pack a nutritional punch that is hard to beat. In fact, it is thought that the first carrots were harvested for medicinal purposes. Over the ages, they have been used to treat everything from ulcers to kidney stones. They were even once considered an aphrodisiac.

The carrot is perhaps most famous for promoting good eyesight, which turns out to be a rather exaggerated claim. It's true that, of any vegetable, carrots have the highest levels of beta-carotene, a nutrient our bodies convert to vitamin A. Although vitamin A is known to encourage good eye health, eating lots of carrots will not bring you any closer to 20/20 vision.

As far as myths go, this one has a pretty noble beginning. When the Nazis were bombing London during World War Two, the British managed to develop radar technology that allowed them to shoot down German planes at night. To keep the

technology a secret, the British army spread the story that their anti-aircraft personnel gained this extraordinary ability by eating a lot of carrots!



While they will not give you night vision, carrots are still amongst the healthiest vegetables around. They provide a lot of cardiovascular and anti-cancer (especially colon cancer) benefits. They are



also one of the only veggies that can be better for you when slightly cooked, as cooking breaks down the resistant cell walls that trap beta-carotene.

Carrots are particularly interesting as an example of the inherent problems and possible solutions to how we grow our food. Even though they grow very well in many parts of Canada and can store for months, we still import over 100,000 tons of carrots each year. That means one in five carrots is

being transported to Canada from another country. Organic carrots are imported at a sharply higher rate; only one in every thousand organic carrots consumed in Canada is grown here! Almost all of the imported carrots are brought in from the United States. In just a single year we imported \$88 million in carrots and \$22 million in organic carrots. That is a lot of money to spend on something we can grow quite easily here in Canada.



THE FARMS THAT GROW OUR CARROTS

Who grows carrots? Probably nobody you know if you are the average Canadian.

In 1933, one in three Canadians lived on a farm. Today, however, just two percent of Canadians are living on farmland. So if you live in the city, like most of us, you are not likely to run into your local farmer at the gym. And since more of the carrots we eat are being produced further and further away from where we live, you are unlikely to run into a carrot farmer at a general store in a small Ontario town. To get a sense of the immense changes that carrot farming has undergone in the last eighty years, let us explore three different farms, each sporting a fictional name, but all based on a very real farm that exists today. In one sense, the choice

of three farms is arbitrary. There are as many ways to farm as there are farms. These three were chosen because they demonstrate how most carrots are grown, and they showcase important alternative approaches. As we will see, the ways in which each farm chooses to grow carrots has huge consequences on jobs, our soil, our water, and our health.

Mega Inc. Farm is the largest of our farms. It is scattered in several regions of California over an area spanning 35,000 acres (each acre is about the size of a football field). Mega Inc. Farm produces a billion pounds of carrots a year and is owned by a large corporation that makes canned goods and juices. It supplies two of every five carrots sold in the United States and exports to thirty countries, including Canada. About 15% of Mega Inc. Farm's fields are certified organic (we will explore what that certification means in the Market section). You will find both organic and non-organic carrots, baby-cut carrots, and carrot juice from Mega Inc. Farm at big chain grocery stores. Mega Inc. Farm's parent company is based on the East Coast and brings in almost \$10 billion of revenue each year.





Moon Family Farm is a mid-sized farm that sits on about thirty acres of land. It is located just over an hour's drive north of Toronto, Ontario. The land has been in the Moon family since the early 1930s and the farm grows a range of vegetables and raises some livestock. It sells its produce, including carrots, at several farmers markets and also wholesale to the few remaining independent grocery stores in the area. Moon Family Farm uses as little chemicals as possible and is certified under a local standard. It grows about four acres of carrots and typically sells them within a one-hour drive of the farm.



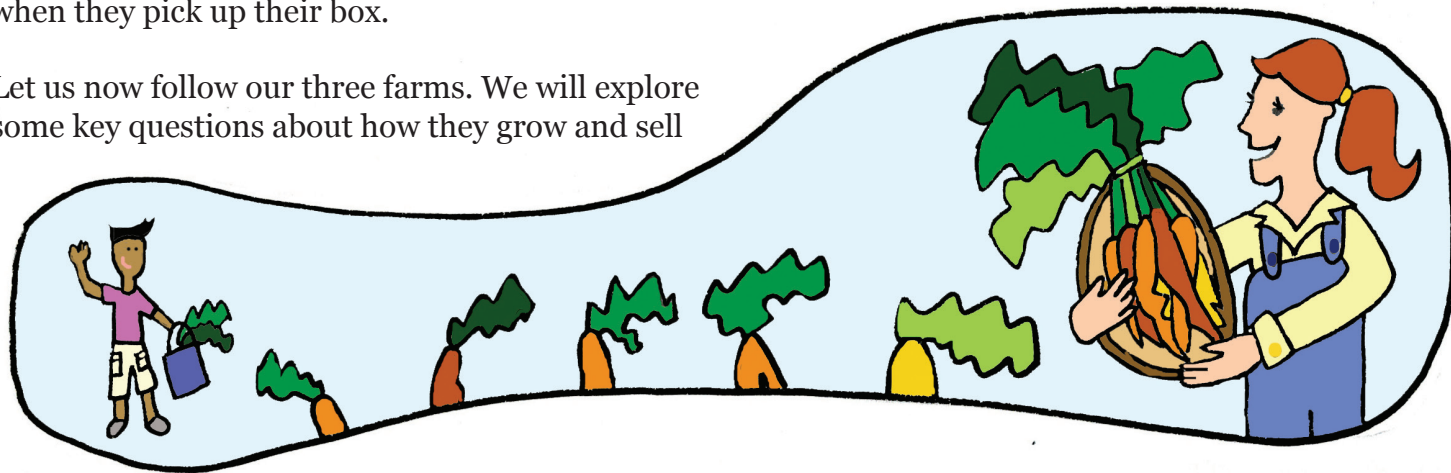
Bluma's Farm is a two-acre market garden located about two hours east of Toronto. Previously



a hobby farm, it was transformed into a working farm five years ago by the owner, Bluma. The farm uses only organic and biodynamic practices and grows a variety of produce. Bluma sells her produce through a 75-member box program where members pre-pay for their produce at the beginning of the growing season and then receive a box of produce each week. She plants about a quarter acre of heirloom organic carrots and sells them locally. The carrots often do not even make it off the farm and are instead handed over to members when they pick up their box.

Let us now follow our three farms. We will explore some key questions about how they grow and sell

carrots. How is the soil prepared? Which seeds do they use? How are weeds and pests controlled? Who harvests the carrots? To whom are the carrots sold? What is their impact on our health and the environment? Each of these questions merits a book series in its own right. And yet, as eaters, we have to start somewhere. As we will see, we can no longer afford to outsource our decision making to the so-called experts in universities, government agencies, or businesses who dictate how our food is grown.



CARROTS [AND CIVILIZATION] NEED SOIL

Living in cities, it is easy to forget that land is the anchor of civilization. All of the food we eat ultimately depends on those top few inches of soil. Soil is a precious resource that is not renewable, at least not within our or our great-great-great-great-great-great-great-great-great-great-grandchildren's lifetime. An inch of good topsoil can take one thousand years to build, and to find that topsoil in the right climate with enough water nearby is pretty rare. Only about one in every twenty acres of Canada is viable farmland, and just one in every two hundred acres is considered really good farmland with no major limitations to farming.

The sad reality is that we are paving over much of our best farmland. Beneath the detached homes, sprawling lawns, wide roads, and strip malls of the suburbs, lies some of the world's best soil. For example, the Moon Family Farm is right across the road from one of Toronto's newest suburban communities.

To produce food year after year, soil needs to be treated well. Although carrots are not the fussiest plant, they still need good soil with a lot of organic matter to feed their hungry roots and a host of micro-organisms like bacteria to break down that organic matter. Good soil is inviting to the worms that help fertilize it. Worms are a farmer's best friend because they help loosen the soil, resulting in better drainage and easier root growth. Worm poop is also considered "black gold" as a fertilizer.

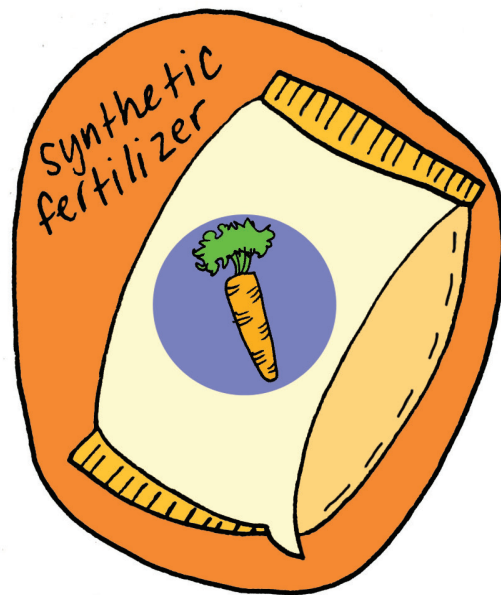
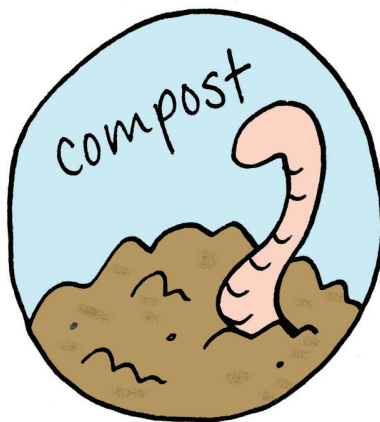
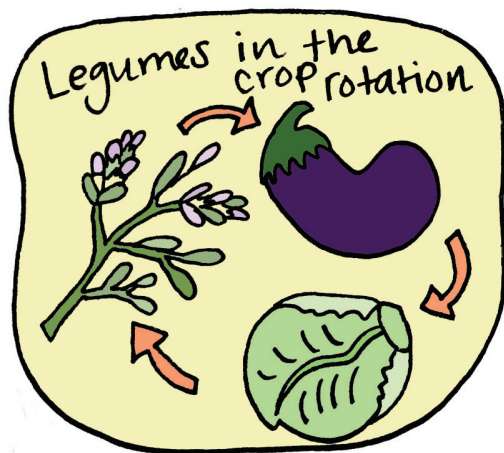
One of the most important nutrients or fertilizers for growing almost any kind of crop is nitrogen. Although over three quarters of air is nitrogen, it is not in a form that plants can use.



There are a few ways to help convert or “fixate” nitrogen into something soil can use, both naturally and synthetically.

One natural method is to plant legumes, such as alfalfa, as part of the crop rotation. Rotating crops means that the same crops are not growing in the same field year after year. Another way is to add either composted animal manure or composted plant matter, like vegetable scraps, to the soil.

In 1915, two German scientists discovered a “synthetic” way to fixate nitrogen called the Haber-Bosch process. These synthetic fertilizers are similar to their organic counterparts in that they contain fixated nitrogen and other key nutrients.



You may be wondering what the difference is between natural and synthetic fertilizers. The answer in one word is convenience. Synthetic fertilizers release the nitrogen into the soil quickly. They also free farmers from the complexity and effort involved in using organic fertilizers. For example, crop rotation requires lots of planning and may limit which crops can be grown. Raising livestock and collecting, composting, and spreading their manure can also be time consuming and expensive.

So, what is not to like about synthetic fertilizers? Plenty. For starters, they take a lot of energy to produce. Almost ten litres of natural gas is needed to produce a single 40-pound bag of synthetic fertilizer.

Mega Inc. Farm often uses up to 120 pounds of synthetic fertilizer per acre, which is a lot of gas for 35,000 acres! That means more environmental damage from extracting and piping that gas, as well as the climate change impact of burning it. It also means that the price of our carrots and other food now depends to a large extent on the price of

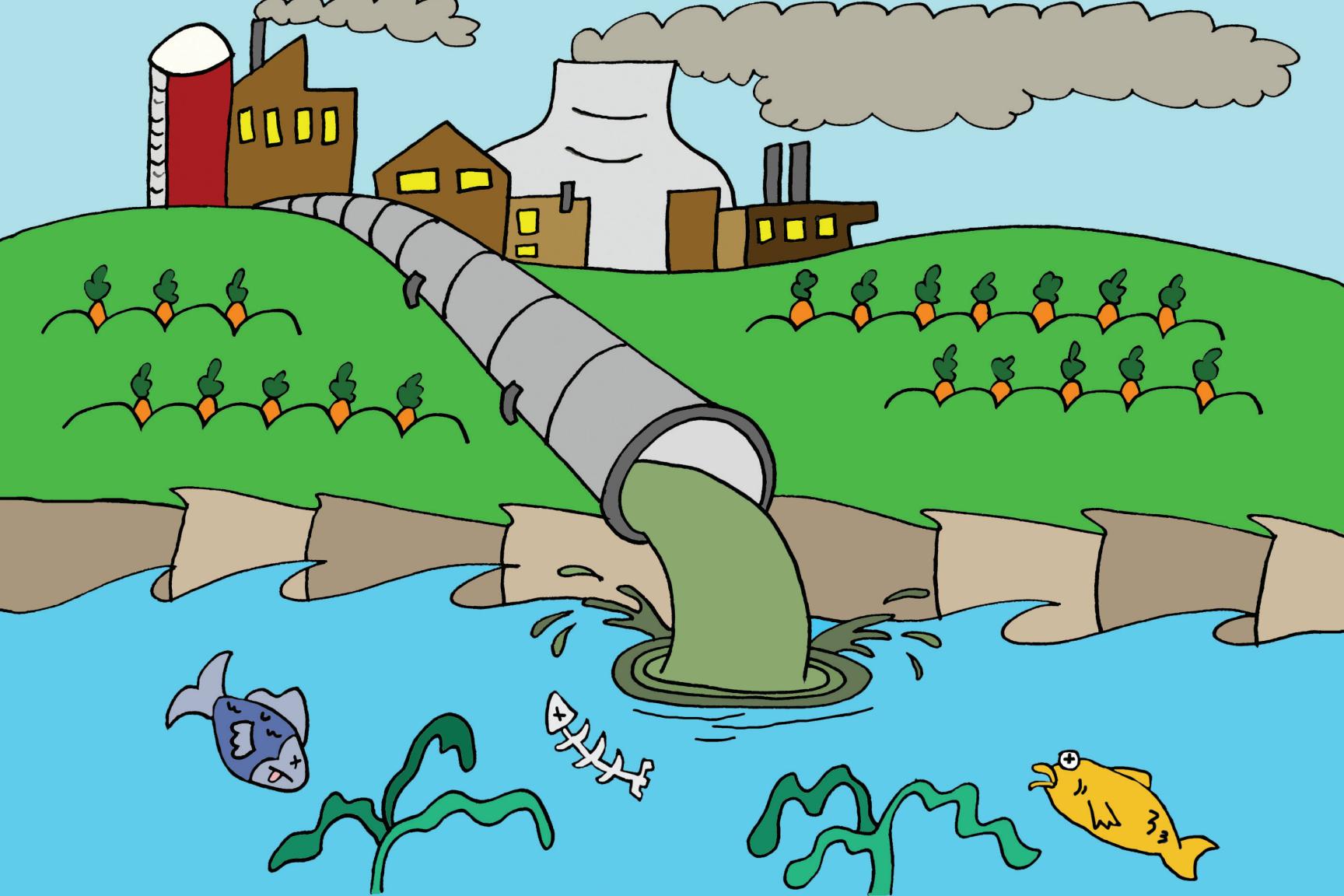
natural gas. When gas prices go up, food prices go up too.

Synthetic fertilizers also greatly increase the chance of nitrogen runoff into surrounding waterways and ground water. Even when the fertilizer is spread efficiently, plants cannot make use of all of the nitrogen it contains.

Fertilizer runoff has been identified as the chief cause of hundreds of gigantic “dead zones” in bodies of water around the world. Organisms like algae will thrive when there are high levels of nitrogen in a lake or ocean, and too much algae is effectively a death sentence for other organisms like fish. In our own neighbourhood, Lake Erie and the St. Lawrence estuary have seen severe algae blooms and dwindling fish stocks.

This runoff can also have a direct impact on human health. High levels of nitrate-nitrogen in drinking water has been associated with increased rates of some cancers, skin rashes, hair loss, and birth defects.





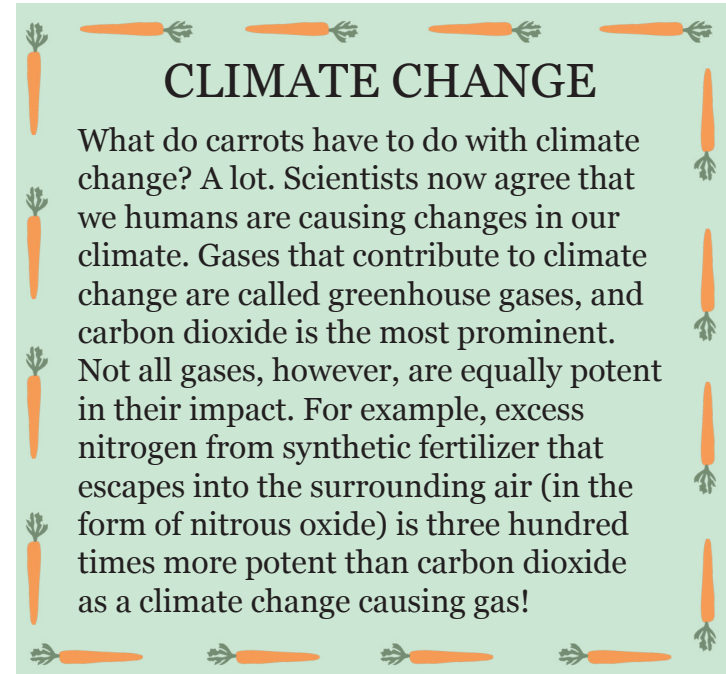
So how do our three farms fertilize their soil? Whichever method they choose, it will have a direct impact on the carrots they grow and we eat.

Since Bluma uses only organic practices at her farm, she fertilizes her soil with composted animal manure and plant matter and plants alfalfa in her crop rotation. Carrots are a great addition to Bluma's rotation because they are relatively light feeders. They give soil a much needed break from heavier feeders, such as cabbages or tomatoes.

The Moon Family Farm uses a hybrid approach to fertilize its land. It does not always have enough of its own livestock's manure to spread on the field. Also, its ability to rotate crops is limited by the kinds of produce it has found a market for. The farm ends up using some synthetic fertilizers for their carrot crop's nitrogen needs because of these limitations.

Mega Inc. Farm also uses a few different practices. Most of its carrot acreage is fed nitrogen by synthetic fertilizer. The small part that is farmed

organically is fed natural fertilizer, like animal manure and plant compost, that is brought in by trucks from outside the farm.



CLIMATE CHANGE

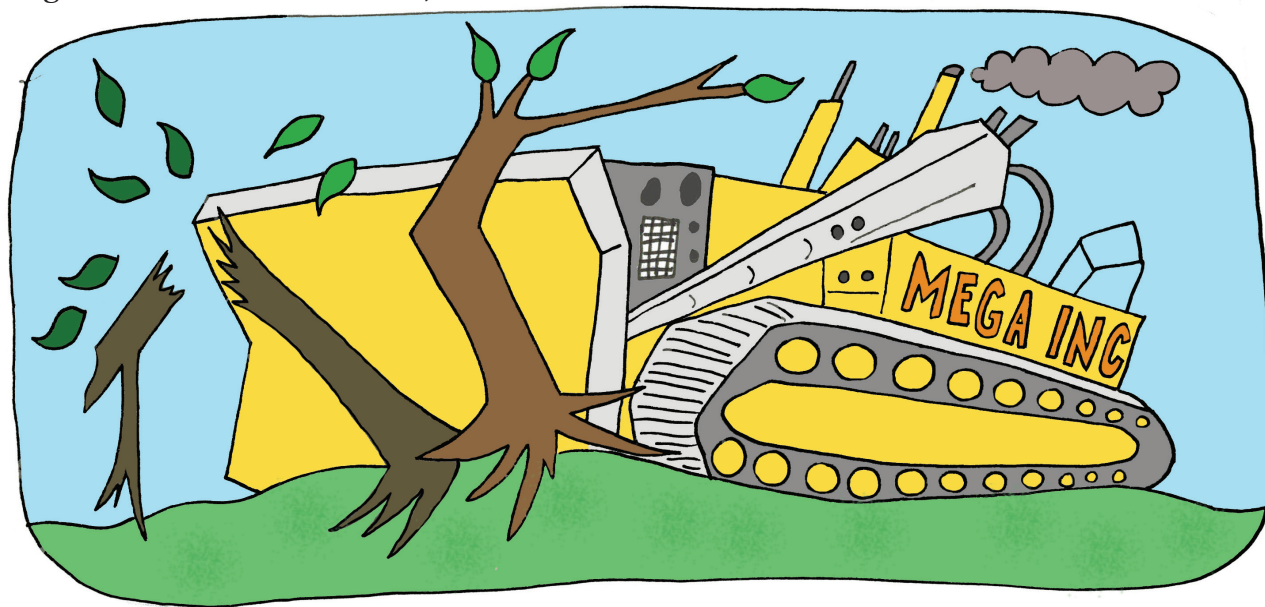
What do carrots have to do with climate change? A lot. Scientists now agree that we humans are causing changes in our climate. Gases that contribute to climate change are called greenhouse gases, and carbon dioxide is the most prominent. Not all gases, however, are equally potent in their impact. For example, excess nitrogen from synthetic fertilizer that escapes into the surrounding air (in the form of nitrous oxide) is three hundred times more potent than carbon dioxide as a climate change causing gas!

Greenhouse gases released by food production and consumption, including carrots, contribute to



about 14% of total human greenhouse gas emissions. This includes fertilizer production, farming, processing, transport, retail, household food management, and waste disposal. What this figure does not account for is the destruction of forests and wetlands for farming purposes. These forests and wetlands are much more efficient at capturing and storing carbon than a carrot field, so when we

destroy them, we are also destroying our air. As we will see in the *Water Section*, Mega Inc. Farm's carrot farms in California have been a significant contributor to wetland destruction. It is estimated that the pollution created from land use change contributes to between 4% and 18% of global emissions.



CARROT FARMING IS A SEEDY AFFAIR

It is an age-old question: which came first, the seed or the carrot? For most edible plants, the seed is where it all starts. Since carrots are not a fruit, there are no seeds inside or on the carrot. Instead, the seeds come from their flowers. Carrot seeds are very small; three thousand of them would fit on one teaspoon.

All three farms use various forms of automation to seed their fields.

Mega Inc. Farm and Moon Family Farm put special attachments on their tractors that spread seeds very efficiently and effectively. At Bluma's Farm, they use a bicycle-like contraption seeder that a person pushes along each carrot row.

But where do the seeds come from? Fewer and fewer places, as it turns out. Not so long ago, farmers would typically save some or all of the seed they needed from the previous year's crop. Gradually, this function has shifted to seed companies that specialize in seed saving. The seed industry has been undergoing rapid consolidation over the last two decades. Fertilizer and biotechnology companies have been gobbling up hundreds of smaller seed companies and now just ten companies account for seven out of every ten seeds sold. These companies are able to sell mass amounts of seeds by using the existing marketing and distribution advantage they have through selling fertilizer and pesticides. The largest company, Monsanto, sells \$10 billion of seeds each year alone. This concentration is a problem for two reasons: price and diversity.

Basic economics tells us that the more concentrated an industry is, the more pricing power the supplier has. And seed costs have indeed gone up as seed companies get bigger and bigger. While the impact on carrot seed prices has not

been felt yet, corn seed prices have been known to increase by 32% in one year!

The other important issue is retaining biological diversity in the face of this consolidation. In the pursuit of making money, less profitable seed lines are often eliminated in the process of acquisition. The variety of available seeds then dwindles, resulting in farmers only being able to buy seeds that may not be suitable for their given region or climate.

Mega Inc. Farm gets its seed from large US-based suppliers. In fact, the parent company of Mega Inc. Farm recently sold its seed division to one of these corporate giants.

The Moon Family buys their seed from the same large supplier in the United States as Mega Inc. Farm, but at a higher price. Due to their tremendous buying power, larger farms usually get the better quality seed at a better price.

Bluma's Farm bucks the trend altogether by not

buying seeds at all. Bluma saves her own seeds. While time consuming, the benefits are that she can better predict her seed costs and can select seed varieties that are particularly well suited for her farm's soil and climate.



HOW CARROTS ARE WEEDED

To grow plants that you want to eat, you need a strategy to deal with those pesky plants that you do not want to eat: weeds. A weed is any plant that stops or stunts the growth of a crop by shading it, choking it, or competing with it for nutrients and water. To grow carrots effectively, it is really important to weed after the carrot plant first begins to emerge from the seed. Failure to control weeds at this point can result in far lower yields.

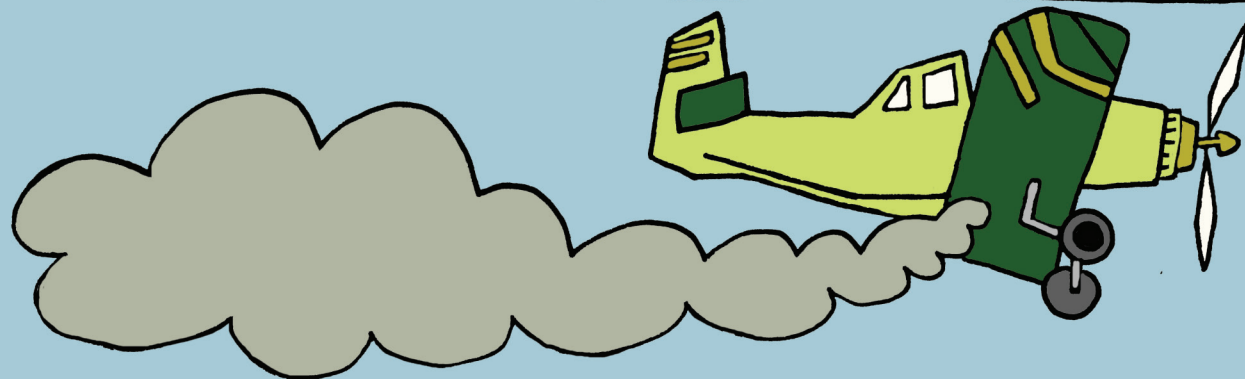
Bluma's Farm handles weeds in several different ways. Bluma prevents invasive weed species from taking root by cleaning farm equipment so that the species does not take hold in other parts of her farm. She also uses crop rotations and cover cropping. Cover cropping involves planting rye in

the late fall that she ploughs into the soil in the early spring so weeds cannot take root. And of course, like most home gardeners, she also weeds her crops by hand.

The Moon Family Farm uses many of the same techniques as Bluma. In addition, it uses special tractor-mounted flame throwers to kill emerging weeds right before planting begins. Using flame throwers to control weeds is more environmentally friendly than chemicals. Indeed, flame throwers were popular up until herbicides began their dominant reign in the 1950s.

Mega Inc. Farm uses several types of chemicals called herbicides to control weeds on its non-organic acreage as well as pesticides to control unwanted insects. And it is not alone. Recent carrot testing came up with over two dozen chemical residues on carrots! The most common residue detected was a chemical called linuron, which was found on one in every five non-organic carrots. It is worth exploring this chemical a bit further.





Linuron is the most widely used herbicide for controlling weeds in carrot farming. In fact, over 80,000 pounds of linuron are applied to crops each year in California. It is used both before the carrot plant emerges from the seed and after. Since it is so commonly used, it is reasonable to ask, is linuron safe?

Canadian and American authorities have concluded that linuron is a possible carcinogen and a hormone disruptor with negative impacts on a fetus or baby. And that is just in humans. With animals, where we can test the impact more directly, the news is clear and it is ugly. In mice and rats, ingesting linuron caused liver and testicular cancer.

Health Canada concluded that mixing, loading, and applying chemicals like linuron involves unacceptable levels of risk to farmworkers, who are often migrant or illegal labourers with no other work to turn to and no say in workplace safety. It is unsurprising, then, that an estimated twenty-thousand farmworkers get pesticide poisoning in the United States each year.

So why is the government not stopping farmers from spraying linuron on carrot fields? Some governments already have, including Sweden and Norway, and Health Canada recently published a report suggesting a ban on the harmful chemical. In response, the manufacturer of linuron, a company with \$3 billion in revenues, very quickly began waging a concerted campaign to discredit the report and has been rallying a coalition against it. Now it is a waiting game to see who will win: our health and environment or a company with millions of dollars of revenue at stake.

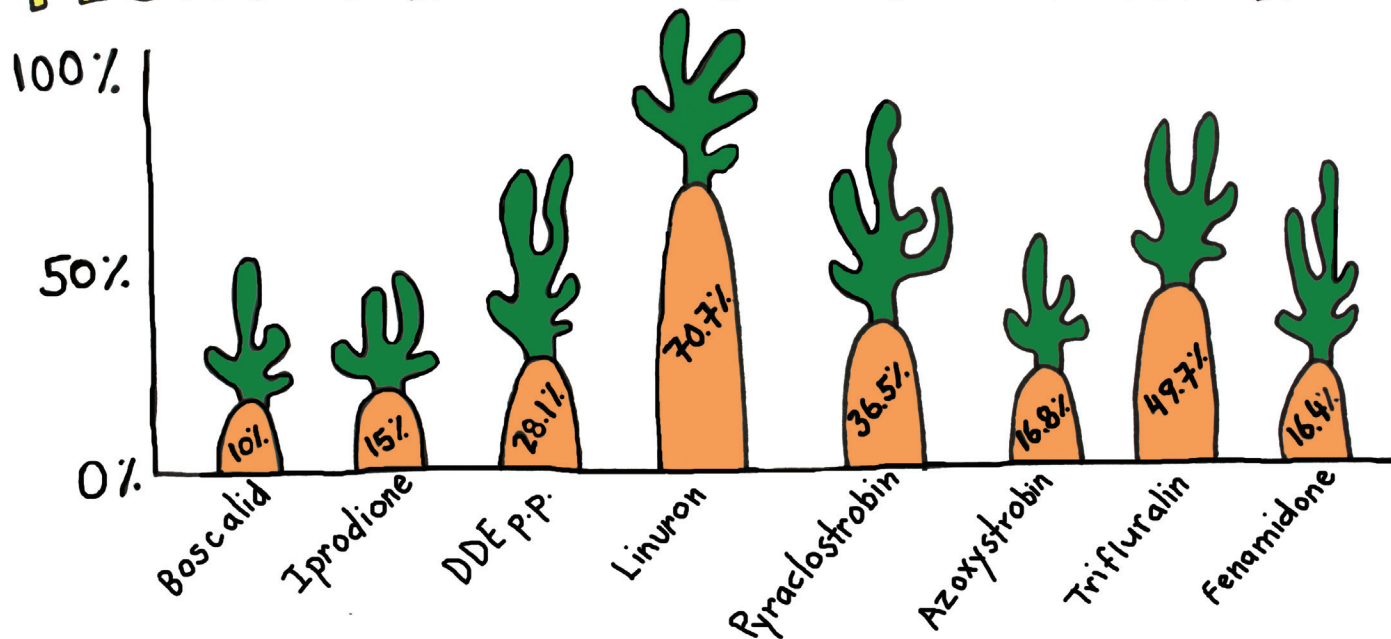
That is the thing about pesticides and herbicides. In theory, a government that understands the pros and cons of using this or that chemical would make the right choice. In practice, however, government agencies are subject to direct and indirect pressure from large businesses. These companies and their allies can deploy an army of lobbyists, lawyers, and cherry-picked researchers to cast doubt on scientific findings and exaggerate the economic implications of banning a given substance. They sponsor friendly research. They lobby politicians.

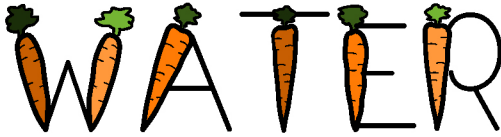


They build coalitions up and down the food value chain, from farms like Mega Inc. Farm to the retailers that Mega Inc. Farm sells to, in order to rally to their cause.

Getting rid of weeds that compete with carrots using chemicals once seemed leading edge. But now that we are finding out more and more about their ill effects, it is looking increasingly shortsighted.

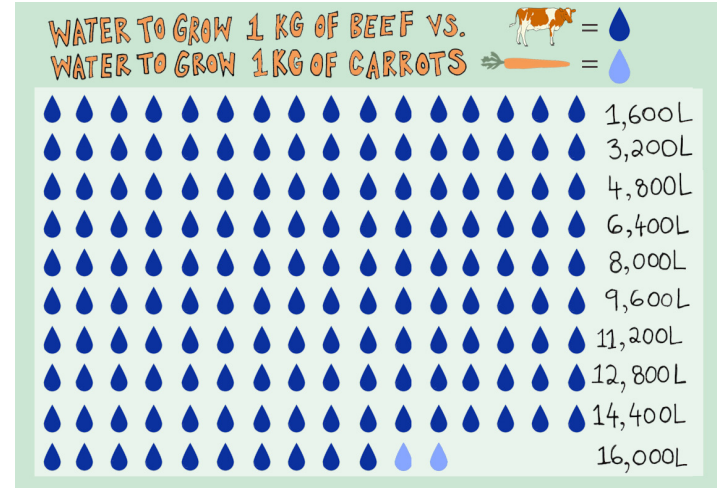
PESTICIDE RESIDUE FOUND IN CARROTS





It may seem obvious to mention that you need water to grow anything, carrots included. What may not be obvious is how much water is needed and how much of an impact farming can have on the quality of our water. In a world with a growing population and a more intensive use of water resources, water issues will reign supreme in the coming century.

The first thing to note is that eating vegetables, whether produced by Mega Inc. Farm, the Moon Family Farm, or Bluma's Farm, is far more water efficient than eating meat. For example, a kilogram of carrots needs 195 litres to grow, whereas a similar amount of beef needs a whopping 15,400 litres of water.



It is important to know the consequences our eating habits have on our water.

We have already touched upon some of the effects of the synthetic fertilizers and pesticides used by Mega Inc. Farm and the Moon Family Farm on water. Leakage is inevitable. When you spray billions of pounds of any chemical on giant parcels of land, there is bound to be runoff into rivers, streams, lakes, oceans, and underground water supplies.



Another major issue is that fresh water is scarce. Imagine that all the water on earth is represented by one thousand drops. Only twenty-five of those drops represent fresh water. On top of that, just a quarter of one drop represents fresh water that is available for human use, the rest being trapped in icebergs and other hard-to-reach places.

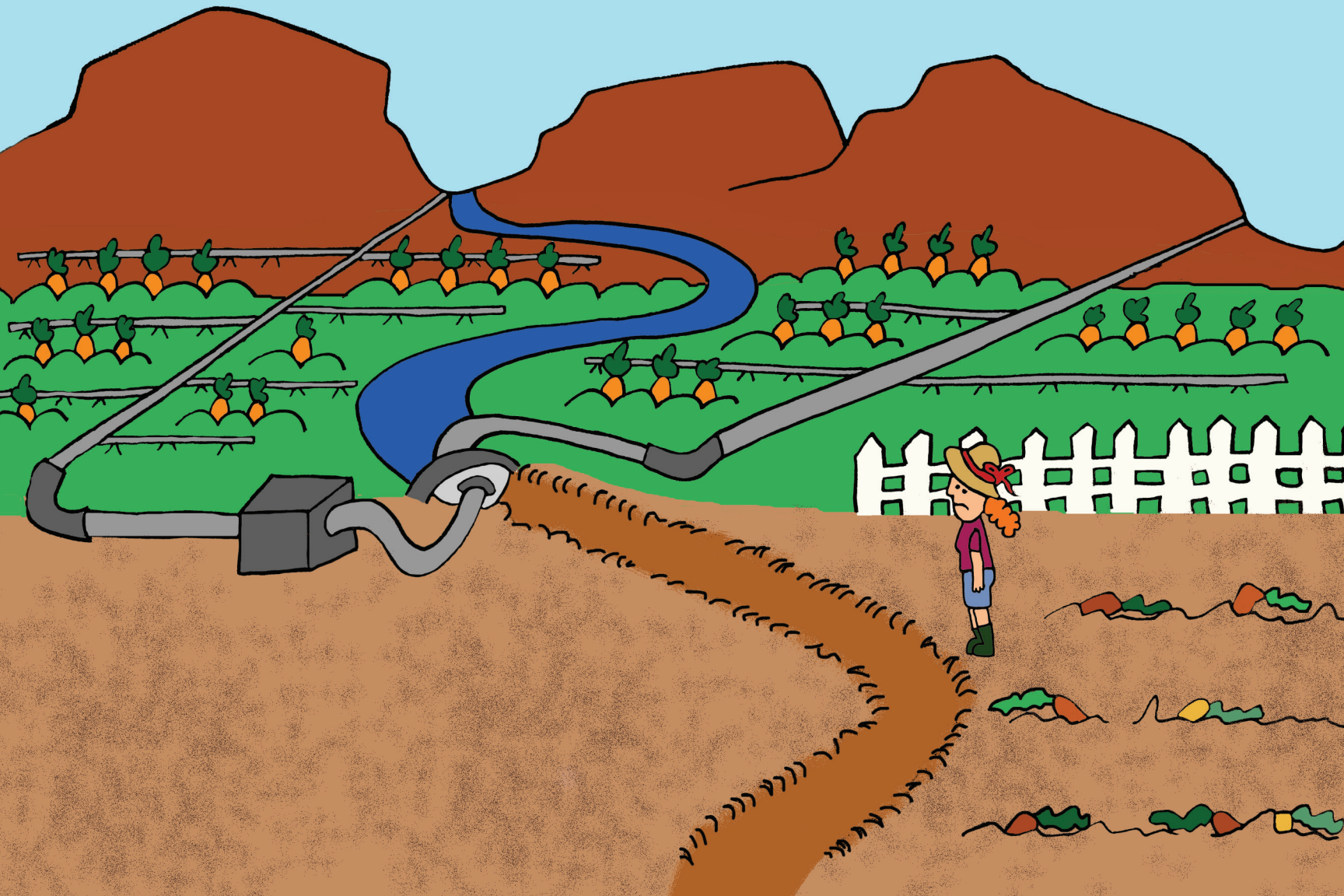
A tragic example highlights these issues well. Much of Mega Inc. Farm's land is located in California's Imperial Valley. This valley is a desert that has been transformed into one of California's prime farmland regions through irrigation from the Colorado River. Unlike our traditional idea of a river, the Colorado River no longer flows to the sea because too much water has been diverted to irrigate the naturally dry soil.

Almost 80% of the river's flow is now used up by farming. This has resulted in the annihilation of dozens of species that lived in the wetlands previously fed by the river, including fish, shrimp, and sea mammals. Many of the reservoirs along the Colorado River are expected to almost completely

dry up by 2021 if current practices continue. What little water still flows through the Colorado River system is heavily polluted and salinated due to runoff from farming activities. Especially toward the lower reaches of the river, after the water has travelled over two thousand kilometres, the salinity of the water is up 40 times its original state. This high salinity is causing crop damages totalling hundreds of millions of dollars and is a perfect example of a polluter being directly impacted by their own pollution!

Our three carrots each use roughly the same amount of water. The difference lies in how they impact fresh water supplies. Bluma's Farm does not pollute the water under or around its land because no chemicals are used. Both Bluma's Farm and the Moon Family Farm grow their crops in Southern Ontario, an area that is suitable for farming in terms of water availability. In contrast, much of Mega Inc. Farm's land is in parts of California where water supplies are dwindling and becoming ever more polluted by intensive farming.





HARVEST

Now that the carrots are seeded, weeded, and watered, it is time to harvest. Who does the harvesting? There are two options: human or machine.

On industrial farms, the whole farm is geared towards automation, including the type of soil, the row spacing, and the type of carrot variety seeded. Large 65,000-pound harvester machines loosen up the soil and then pull out the carrots by latching onto their greens. They load them up into industrial-size trucks, and off they go to the processing plant where the washing, sorting, cutting, and packing are also automated.

Over at Bluma's Farm, she works with two interns who help get her heirloom carrots out to market.

All harvesting and post-harvesting washing and packaging are done by hand. This means much more human labour, but on Bluma's relatively small scale farm, it does not make economic sense to go into debt by purchasing expensive machinery. The upside for Bluma is that she can change her crop plan next year based on soil conditions, something much larger farms cannot easily do because of large investments in carrot-specific machines.

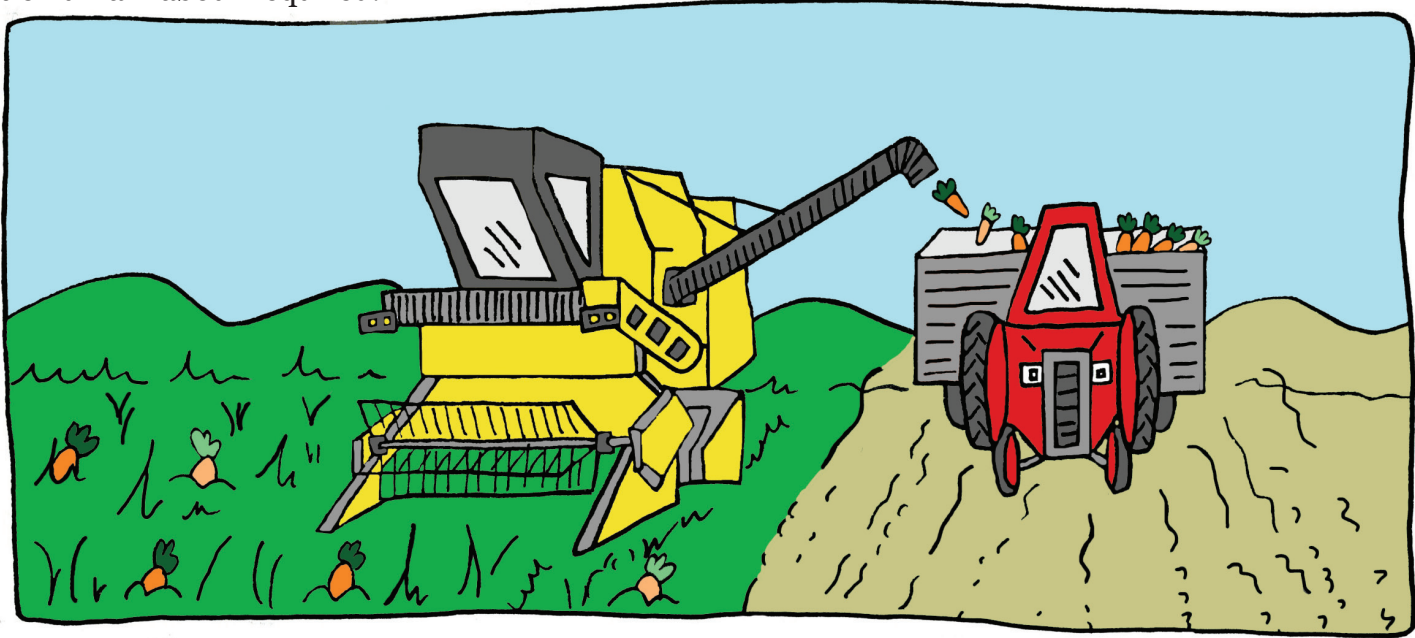
At the Moon Family Farm, several seasonal workers from Jamaica do most of the harvesting. The workers arrive in Ontario through a special arrangement between the Canadian and the Jamaican governments.

Compared to migrant workers in many other countries, the ones who come to Canada are guaranteed minimum wage, living quarters and health insurance, but they are still vulnerable to unscrupulous employers. The Moon Family, however, takes its responsibilities as an employer very seriously and it shows; over 80% of the workers come back to work at the farm year after

year. Harvesting is done by hand, although there are pickup trucks to transport the carrots from the field to the washing station.

The Moon Family has also created a purpose-built giant pool so the carrots can be washed with very little human labour required.

Mega Inc. Farm only uses migrant labour for their few non-automated tasks. The high degree of automation at Mega Inc. Farm means less overall farm jobs, and indeed studies do show that conventional farms typically use about 60% of the labour used on organic farms per acre.



Those who support industrial farming often say something along the lines of, “Sure, we don’t like to use chemicals either, but if we all go organic, the world will starve!” It is true that the fields on Bluma’s Farm will yield fewer carrots than Mega Inc. Farm, but before going into the yield debate, it is important to realize three things.

First, most farmland is not actually used to grow food. It is used to feed our cars (ethanol made by fermenting corn), our livestock (corn-based feed), our lifestyle (detached homes built on farmland), and our bad habits (half of food is wasted). So even if avoiding chemical use does mean less yield, it just means we have to use farmland more wisely.

Second, it is crucial to ask which yield we are referring to. It may be that Mega Inc. Farm produces more pounds of carrots per planted acre than Bluma’s Farm, but what about the decreased “yield” of acres of destroyed wetlands in the Colorado? Or the decreased “yield” of a farm worker injured by a pesticide spill? Or the decreased “yield” of entire cities impacted by the

climate change that farming contributes to? Finally, we must consider yields in their proper timeframe. The land must be treated in a way that ensures it remains productive for decades and centuries to come. There is little point in coaxing twenty-thousand pounds of carrots per acre this year if it means we only get five thousand pounds a decade from now because we have destroyed our farmland.

With this background in mind, how many carrots do each of our three farms yield?

Mega Inc. Farm comes out on top on a per planting basis. The Moon Family Farm is fairly close with about 90% the yield of Mega Inc. Farm, and the yield from Bluma’s Farm is approximately 78% of Mega Inc. Farm.

These numbers reflect a recent report summarizing ten different research studies that found the yield from organic carrot fields varies between 76% and 106% of their conventional counterparts. The differences between conventional and organic also

really depend on the type of crop, where it is grown, and how the land is farmed.

For example, there are large yield differences between conventional and organic for certain fruits in Ontario such as peaches or plums. Our humid climate during the growing season often provides a hospitable environment for fungal infestations.

Moreover, even within the broad categories of “conventional” or “organic farming” it is difficult to compare yield because there are dozens, if not hundreds, of ways to farm.

To be sure, farming sustainably does not mean that we all go back to farming as it was one hundred years ago. There have been many important advances in agriculture aside from the invention of pesticides, herbicides, genetically modified seeds and synthetic fertilizer. For example, Bluma uses drip tape instead of relying on rain to irrigate much of her farm. The Moon Family uses tractors for ploughing, spreading compost, flame-thrower weeding and harvesting carrots. The list goes on.

Aside from modern technology and know-how, sustainable farming also makes use of human ingenuity to a greater extent than industrial farming. Instead of simply complying with a fertilizer or pesticide company’s instructions on how to apply this or that chemical, the farmer needs to go through a much more complicated set of considerations that are unique to his or her crop and land.

When a carrot yield is not as high as expected, there are many things to be considered. What was planted here last season? Was the cover crop ploughed in too early, allowing weed pressure to build up? Can another crop be planted between carrot beds to ward off certain pests? Did improperly washed tractor implements introduce a weed from one field to another?

These are questions that only knowledge and experience can answer. And this knowledge and experience is often specific to a certain region or even specific field.



Now it is time to find a buyer for the carrots from our three farms.

In a typical city, eaters have three main options when it comes to buying their carrots. There are the large national grocery chains. Then there are some smaller independent grocery stores with one or a few locations. Finally, you can buy direct-from-the-farm through options such as a box delivery program, a CSA or farmer's market.

In Canada, three conglomerates control about three quarters of our grocery dollar. In fact, most of the smaller grocery chains you see out there are ultimately owned by one of the big three.

This consolidated market spells big trouble for smaller farmers.

For the most part, the national grocery chains only want to deal with the Mega Inc. Farms of the world, not the Moon Family Farms or Bluma's Farms. This way, they deal with as few farm suppliers as possible and pay as little as possible for a guaranteed year-round supply of carrots.

Even if they could compete on price with farms in California or elsewhere, the Moon Family Farm and Bluma's Farm may not be able to provide year-round supplies or enough pounds of carrots per store. For these reasons, it is unlikely that the larger grocery chains will buy from them. This is one reason buying from smaller grocery stores with a local food focus is important; smaller local farms are increasingly being shut out of the market.

Buying local can also mean less fossil fuels are burnt in transporting the carrots from the farm to the retail store. It means more money for the local economy, and it means food is more nutritious because it has not spent as much time in transit.

These options are reflected in the way our three



farms choose to sell their carrots to the consumer.

Bluma pre-sells some of her heirloom carrots through her member box program. Members pay ahead of time for a season of weekly box pickups featuring produce from Bluma's Farm and she takes the rest to a local farmers market. By selling directly to the consumer, Bluma is able to capture the full retail value of her produce. This is in stark contrast to produce in large grocery stores where farmers keep only one or two dollars for every ten dollars shoppers spend.

Moon Family Farm strikes a middle ground. It wholesales to several small and medium-sized retailers rather than grocery chains with hundreds or thousands of stores. The farm is then able to keep more of the retail dollar per carrot sold.

The Moon Family also sells their carrots at several farmers markets. By distributing their carrots through these two channels, the Moon's minimize the risk to their livelihood if one or two buyers stop buying from them for some reason.

ORGANIC CERTIFICATION

Certified organic means three main things from a farming perspective: no genetically modified seeds, no synthetic fertilizer and no chemicals used to kill pests or weeds.

To ensure compliance with these requirements, an inspector reviews farm practices and records each year. They are also required to have a buffer zone if adjacent land is not organic.

It is important to appreciate that certified organic does not necessarily mean a product is healthy. Organic also does not mean labourers were treated well during the growing or making of food. Finally, organic does not mean other environmental issues not covered by certification were properly addressed.

Mega Inc. Farm sells primarily to large national grocery retailers through its parent company. The parent company sells carrot products such as baby-cut carrots, carrot juice, and canned soup, as well as other packaged goods.

From Mega Inc. Farm's perspective, whether it sells conventional or organic carrots, or even canned soup containing carrots, does not matter. Mega Inc. Farm will grow and sell organic carrots to the extent consumers demand it, not because it is good for the environment or for human health.

This plays out in comical, if sad, ways. For example, Mega Inc. Farm's parent company recently spent over half a million dollars lobbying against the labelling of genetically modified foods in California. In other words, they want to prevent more information from reaching consumers about the food they eat because most of their carrots and related products are not organic and therefore contain genetically modified ingredients. This very much goes against the spirit of certifying organic in the first place.

For example, just because Mega Inc. Farm's organic carrots are certified, some of the farm's practices may still be bad for the environment. An organic farm is not restricted from planting monocrops (i.e. just carrots), depleting precious water supplies, or treating workers unfairly.

The Moon Family Farm has chosen not to certify organically in favour of a local certification called Local Food Plus. This certification, developed in Ontario, ensures certain labour standards are met and requires continuous environmental improvement, including reduced use of pesticides.

Bluma's Farm does not certify organic because of the cost associated with certification. Instead, she focuses on building relationships of trust directly with her customers. Since her customers know Bluma and can visit her farm, they feel comfortable that her farm uses organic practices. Moreover, they know that she treats her labour well and is a good steward of her land.



CONCLUSION

After reading about our three carrots, you may be wondering which one is best. Which scale or method of farming is the way to go to have our carrot and eat it too?

One thing that is clear, the current approach taken by large industrial operations like Mega Inc. Farms cannot be the solution. We cannot afford fifty more years of chemicals in our water, our land, our air, and our bodies. Farming has to become less reliant on fossil fuels. It has to be kinder to farm workers.

That is not to say that Mega Inc. Farm cannot borrow some ideas from the Moon Family Farm or from Bluma's Farm to make its operation more sustainable. But the fact that it has not done so already suggests that mega scale farms, where

much of our food comes from, are not the place to look for solutions.

We need more farmers that combine grit, technology, and a broad knowledge of farming's impacts on the world. We need farms that are more diversified so that crops can be rotated. All carrots all the time may be good for your eyes, but not for the land. We need to combine crop growing and livestock keeping so that animal waste can be transformed into compost.

It is clear what kind of foods we should be eating more of. We need to eat food that is more plant based and local with less chemicals and processing.

Both the Moon Family Farm and Bluma's Farm provide working models of how more of this kind of food can be grown and marketed. They are not a recipe for how to fix our food system, but they are one answer to those who say that there is no alternative. We also need a kind of farming that provides a living wage to farmers and the labour they employ.



As consumers, this leaves us in a difficult position because good food is not always available or easy to identify. Unfortunately, the system is complex, and it is entrenched. However, inaction is not an option. Each of us, acting alone and with others, need to demand a better food system from our governments, our retailers, and our farmers.


How? Here are some suggestions:

 Ask your school board trustee how your child's cafeteria food is made.


 Talk to your local grocery store's produce manager about their sourcing policy.


 Call your local city councillor and ask why vending machines selling unhealthy food are allowed in your local bus station.


 Tweet your favourite food brand and ask how and where they source their ingredients.


 Write to your local member of parliament to demand more scrutiny of how farming impacts our health and environment.

 Buy directly from farmers and from stores that support sustainable farms.

 Volunteer at an organization that promotes healthy eating for children.

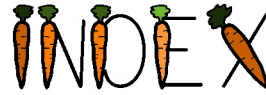
 Subscribe to an organic delivery service or farmer's CSA and share your experience on social media to encourage others to do likewise.

 Try to reduce how much food you waste by planning meals ahead, learning to preserve food and sharing with neighbours and friends.

 Make the time to cook more and eat together with friends and family.

Together we can change the world one bite at a time.





Carcinogen	18	Lake Erie	10
Climate change	1, 10, 12, 25	Legumes	9
Colorado River	21	Linuron	16-18
Compost	9-12, 26, 30	Livestock	6, 10, 12, 25, 30
Crop rotation	9-12, 16	Local Food Plus	29
CSA	27, 31	Manure	9-12
Dead zones	10	Meat	20
Eye health	3, 30	Monsanto	14
Farmers markets	6, 28	Nitrogen	8-12
Farm workers	18, 28, 30	Organic	4-10, 12, 16, 24-26, 28, 29, 31
Fertilizer, runoff	10-13	Pesticide	14, 16, 18, 20, 25, 26, 29
Synthetic	9-12, 20, 26, 28	River	20, 21
Fish	10, 21	Seeds	7, 14-16, 23, 26, 28
Flame thrower	16	Soil	5, 7-13, 15, 16, 21, 23
Grocery stores	5, 6, 27, 28, 31	St. Lawrence estuary	10
Greenhouse gases	12, 13	Topsoil	8
Haber Bosch process	9	Water	5, 8, 10, 13, 16, 20-23, 29, 30
Harvest	3, 7, 23-26	Weeds	7, 16-19, 23, 26, 28
Health Canada	18	Wetland	13, 21, 25
Herbicide	16, 18, 26	William of Orange	2
Imperial Valley	21	Worms	8
Imports	4	Yield	16, 25, 26



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